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SEALS FOR COKE-OVEN DOOR AND USE THEREOF

CROSS REFERENCE TO RELATED APPLICATIONS

This application is the US national phase of PCT application PCT/EP2004/000440, filed 21 January 2004, published 12 August 2004 as WO 2004/067680, and claiming the priority of German patent application 10303808.6 itself filed 31 January 2003 and German patent application 10331658.2 itself filed 12 July 2003, whose entire disclosures are incorporated by reference.

FIELD OF THE INVENTION

The invention relates to seals for coke-oven doors with chambers having an upwardly closed continuous annular door frames that have outer planar seal faces, with door bodies securable to the door frames, and with annular seal elements fixed on the door bodies and engaging the door frames when the doors are closed and its use.

BACKGROUND OF THE INVENTION

There are particular requirements regarding sealing around a coke-oven door, in that a good seal is required that must have a long service life. These requirements are only satisfied by some of the many known door systems. A particular problem is the extremely dirty conditions under which the door must operate, in particular the fouling of the seal strips by tarry substances that precipitate out of the coke-oven gas on the seal strip elements and the adjacent seal surfaces of the door frame. These viscous substances require periodic thorough cleaning that costs a great deal and that can damage the seal strips so that with time the seal

strips of the known doors no longer seal properly. In addition there is the problem that the seal strips must compensate for deformation of the door. Since this door deformation changes with time, the seal strips must be adjustable to compensate.

German 3016165 describes a coke-oven door where a metallic seal strip is hammered for a coarse fit and then urged into position for a fine fit by means of automatic adjusters. With such a (hammer-fit) seal strip there is the problem that the seal strip has considerable inertia in the direction of the desired bending, that is the seal strip cannot fit easily to irregularities in the seal surface so that there are blow-out locations that create leaks. In addition during the coarse hammer fitting there is some recoil. Furthermore if bumps form on the seal surface the seal strip can rock. The hammer-fit seal strip is provided with J-bolts. These J-bolts cannot be optimally set. On the one hand the J-bolts have to be drawn tight to hold the hammer-fit seal strip solidly in position. On the other hand the friction should not be so great that advance of the hammer-fit seal strip is impeded.

The same is true for the setting of the spring forces of the spring biasers. The spring force must be set such that the fixation of the J-bolts is overcome and the resistance of the hammer-fit seal strip to bending is overcome. This means that in some cases a very large force is necessary that requires relatively high door-latching forces. As a result of the high door-latching forces the door latch elements and door frame are subjected to considerable loads. If such a seal is installed (retrofitted) to a

door, the door latches must normally be replaced with units capable of resisting the necessary force.

The hammer-fit seal strip and even other seal strips are normally welded together at the corners. Patches of the seal strips are similarly welded in place. Such welding causes grain and size changes that require a subsequent expensive treatment of the seal strips.

OBJECT OF THE INVENTION

It is an object of the invention to provide a seal for a coke-oven door that can fit to all the irregularities of the door frame with modest latching forces so that the existing door latches can even be used with such a retrofit. In addition the seal should not require weld joints.

SUMMARY OF THE INVENTION

This object is achieved in that a comb-shaped seal strip with a seal edge and slots is fixed on the door body.

The comb-shaped seal strip with a seal edge and slots according to the invention has very low bending resistance. This reduction is dependent on the width and depth of the slots as well as the number of slots. With the appropriate slot depth, slot width, and slot number and material thickness the seal edge of the comb-shaped seal strip is easily deformed and can be fitted very accurately to any irregularities on the seal face of the door frame. As a result of this ability to fit of the comb-shaped seal strip the seal action is significantly improved.

The slots can be made in all known geometric shapes. It is also possible to close slots at their ends away from the seal

edge with webs. Even with this embodiment the bending resistance is greatly reduced. The width of the slots can also be reduced toward their ends remote from the seal edge, so that when the comb-shaped seal strip bends the smaller slot width reduces the bending resistance when the opposite edges of the slots close.

The comb-shaped seal can be secured at spaced locations with screws, retaining disks or springs or with a retaining bar. The retaining bar distributes the retaining forces along the length of the bar.

Hammering on the comb teeth of the comb-shaped seal strip drives the seal edge so toward the seal face of the door frame that the seal face sits sealingly on the door frame. The frictional forces created by the retaining disks or bar ensure that the seal edge does not spring back because of its relatively small bending resistance.

The comb-shaped seal strip according to the invention can be used in new coke-oven doors as well as in existing coke-oven doors. In a coke-oven door with a hammer-fit seal strip only the existing hammer-fit seal strip is exchanged for the comb-shaped seal strip. When retrofitting or repairing, the existing hammer-fit door seal strip does not actually have to be switched. It is possible to also mount the comb-shaped seal strip next to the hammer-fit strip. In this case the comb-shaped seal strip is either provided with its own mount or the existing mounts for the hammer-fit strip can be used.

The comb-shaped seal strip according to the invention is good for repairing seal elements. In case of a repair, when for

example the seal edge of an existing seal strip or the seal face of the door frame is damaged or worn, the mounting of the comb-shaped seal strip on the damaged location can restore full sealing function. In this manner the seal strip is fitted exactly to the worn spot. It is also possible to mount the comb-shaped seal strip at the damaged location right next to the existing seal element.

The sealing between the comb-shaped seal strip making the patch and the existing seal strip is effected by complementarily fitting them together and not as hitherto by welding. Such sealing has the advantage that expensive finishing treatment of the seal edge, as necessitated by a weld joint, can be eliminated.

This sealing by complementary interfitting can be used with all the known seal elements for coke-oven doors known in the art. It is possible to make the joint a mitered or butt or stepped one or even for it to run at an angle. By use of a sealing agent, blowout of the coke-oven gas is eliminated at the start. Afterward tar naturally seals.

This sealing by complementary interfitting can be provided in the region of corner joints. A butt joint can be provided with an additional flexible end seal. A particularly good and long-lasting seal is obtained when a miter cut at a corner joint is provided with a flexible end seal. This end seal can also be coated with an elastic sealing agent.

According to a further embodiment of the invention the flexible seal can be comprised of seal plates that are provided at their ends that project from the butt joint with round heads. In this manner there is a spring action that holds the seal plates in

the gap by spring action. This seal plates can form a cavity filled with a material such as Teflon, glass wool, or the like. The seal plates can also be coated on their outside faces with an elastic sealant.

Sealing of the butting seal-strip ends can be made possible with a T-part. For sealing of gas channels as known from WO 01/30039 a double-T-seal is provided.

The double-T-seal can be made particularly advantageously from the flexible end seals with seal plates and round heads. That is, the seal plates are flattened out until they lie like a double-T-seal on the outer faces of the gas channel.

The sealing can also be done with any other appropriate plug-type connection. Plug-type connections are particularly suitable when they are used with gas channels as in WO 01/30939.

The above-named as well as the other parts that are claimed and described in the examples have with respect to their size, shape, material, and technical conception no particularly exceptional restrictions, so that they can be used in many various applications.

BRIEF DESCRIPTION OF THE DRAWING

Further particularities, features, and advantages of the invention are seen from the following description and the attached drawing in which by way of example preferred embodiments of the seal for a coke over door according to the invention are shown. Therein:

FIG. 1 is a schematic view of the comb-shaped seal strip;

FIG. 2 shows the comb-shaped seal strip with screws and retaining washers;

FIG. 3 is a comb-shaped seal strip with screws and a retaining bar;

FIG. 4 shows the comb-shaped seal strip fitted to irregularities of the door frame;

FIG. 5 is a schematic view of a flexible seal strip with spring action;

FIGS. 6a-6d are various seal strips made without weld joints;

FIG. 7 is a seal strip for a door with a T-part and a double T-part.

SPECIFIC DESCRIPTION

FIG. 1 shows a comb-shaped seal strip 1 that has a seal edge 2. Slots 3 reduces the bending resistance of the comb-shaped seal strip in the direction of the desired bending. The bending resistance can be locally influenced with a given material thickness 14 by varying slot length 4 and slot depth 5.

FIG. 2 shows that the comb-shaped seal strip 1 is mounted at spaced locations by screws 6 and retaining washers 7 on the unillustrated door.

According to FIG. 3 the comb-shaped seal strip 1 is mounted on the unillustrated door by screws 8 and a retaining bar 9. The localized retaining pressure from the screws 8 is distributed along the length of the seal strip by the retaining bar 9.

FIG. 4 shows the comb-shaped seal strip 1 with the retaining bar 9 that conforms it optimally to irregularities 12 and

13 of a door frame 11. Pounding with a hammer on comb teeth 10 drives the edge 2 of the comb-shaped seal strip 1 in spite of the friction of the retaining bar 9 toward the seal face such that the seal edge 2 of the comb-shaped seal strip 1 conforms to the door frame 11.

FIG. 5 shows a flexible end seal formed of two seal plates 15 and 16 that are joined at their ends by round heads 17 and 18. The flexible end seal is set in the space between the ends of two seal strips such that the round heads 17 and 18 flank the seal strips. The round heads 17 and 18 produce a spring tension in the gap. The seal plates 15 and 16 press elastically against the ends of the seal strips. The region between the seal plates 15 and 16 and the round heads 17 and 18 can be provided with a filling 19. This filling 19 can either be a seal material or an elastic material that increases the spring action. In order to further increase the sealing action of the flexible end seal, the outside of the plates 15 and 16 can also be provided with an also elastic sealant.

FIGS. 6a, 6b, 6c, and 6d show various forms of the end seals with or without flexible end seal elements. The seal strips 20 and 21 meet at a miter joint 22, a butt joint 23, a stepped butt joint 24, as well as at an angled joint 25. In order to improve the seal action, flexible end seals 26, 27, 28, and 29 can be provided in the respective joints 22, 23, 24, and 25.

FIG. 7 shows that two seal strips 20 and 21 can be joined at a T-shaped end seal 30 or with a double-T-shaped end seal 31.